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Motive-Demand Dynamics Creating a Social Context for Students' Learning Experiences in a Making and Design Environment

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Abstract

Making and design environments, often referred to as makerspaces, have aroused recent educational interest. These environments typically consist of spaces that support interest-driven engagement in hands-on creative activities with a range of digital artefacts. Although a variety of benefits from participating in making and design activities have been proposed, we currently have limited understanding of students' learning experiences in makerspaces situated in schools. Following Hedegaards' conceptualisations, we investigate motive-demand dynamics in students' social activity in a school-based digital making and design environment, 'The FUSE Studio'. We highlight our findings via vignettes selected from 65 h of video recordings of 94 students (aged between 9 and 12 years old) carrying out activities; the recordings were collected intermittently from an elective course over one

semester. Our study illustrates how the students' learning experiences were shaped through tension-laden interplay between the motives and demands of their activity situated across personal, relational and institutional contexts. The findings make visible how established ways of working and being at school interacted and came into tension with the students' motive orientations, thereby limiting and at times transforming the social context of their learning. Our work also demonstrates how the analysis of motive-demand dynamics offers one useful conceptual tool to unpack students' learning experiences in novel learning environments.

Keywords

Motive
Demand
Tension
Making and design environments
Learning experiences

12.1. Introduction

The contemporary Maker Movement and the broader 'do-it-yourself' (DIY) culture celebrates hands-on innovation, creativity, personal fulfilment and community engagement across a wide array of genres, including crafts, robotics and computing (Schrock, 2014). At present, there is a growing interest in schools for making and design environments, often termed as makerspaces (see, e.g. Lindtner, 2014; Peppler, Halverson, & Kafai, 2016; Blikstein & Krannich, 2013; Blikstein, 2013; Honey & Kanter, 2013; Kafai, Fields, & Searle, 2014; Martinez & Stager, 2013). Making and design environments are offered as a powerful context to foster students' agency, persistence, creative problem-solving, digital literacy, science, technology, engineering and mathematics (STEM) learning and twenty-first-century skills important for workforce development and overall functioning in the contemporary knowledge society (see, e.g. Benton, Mullins, Shelley, & Dempsey, 2013; Bevan et al., 2016; Honey & Kanter, 2013; Kumpulainen, 2017). The New Media Consortium (NMC) Horizon report suggests, moreover, that making and design environments have 'the potential to empower young people to become agents of change in their communities' (Johnson et al., 2015).

Makerspaces prescribe a model of learner-centred pedagogy in which students (or any other participants) can work on personally and/or collectively meaningful projects where they can make choices about their own learning, simultaneously navigating through several fields of knowledge and using technologies that enable them to externalise and share their ideas in concrete shareable objects (Blikstein, 2013; Halverson & Sheridan, 2014; Peppler & Bender, 2013). In sum, making and design activities represent a complex set of socially and materially mediated practices that encompass not only the processes of creating specific artefacts supported by a wide range of technologies and media but also the emotional, relational and cultural processes surrounding their use and construction (Kumpulainen, 2017).

Despite the proliferation of making and design environments, the educational potential of these spaces is still inadequately understood, especially in institutionalised school settings. For some, making and design environments represent nothing more than the progressive, student-centred constructivist educational efforts that have for a long time questioned traditional approaches to schooling (Dewey, 1902; Freire, 1970; Papert, 1980). Some commentators have also warned about the wishful thinking that 'every child is a hacker' and about efforts to impose a very specific mindset—derived from a niche culture—on schools (Blikstein & Worsley, 2016).

The available research evidence on making and design environments (e.g. Peppler et al., 2016) has pointed out critical features that call for attention. This research has shown that makerspaces 'out in the wild' appear to serve mostly adolescents and adults from more dominant and affluent cultural groups, including academically high-achieving individuals and more males than females (Barton, Tan, & Greenberg, 2017). Likewise, educationally focused makerspaces hosted by various cultural institutions have been criticised for their narrowly defined goals and culturally biased activities and, thus, for failing to attract and engage the broader population of young people in learning (Peppler et al., 2016). Research has also warned about the erroneous dichotomisation of abstract thinking and play, about a general ethos of more 'doing' and less 'thinking and reflection', and about a dismissive stance towards the documentation and assessment of student learning and identity development in makerspaces (Blikstein & Worsley, 2016). In general, existing research calls for an increase in the quality and inclusivity of makerspaces and their learning practices and urges further investigation into school-based makerspaces in terms of creating democratic, equitable and deep learning experiences for diverse students.

In this chapter, we aim to contribute to current research knowledge on the educational potential of making and design environments in schools contexts. Following Mariane Hedegaard's (2012a, b, 2014) conceptualisations and cultural-historical theorising, we explore motive-demand dynamics and emerging tensions in students' social activity in a novel digital making and design environment in a Finnish school, 'The FUSE Studio'. The FUSE Studio concept (Stevens et al., 2016) was originally created at Northwestern University in the US and is currently being adopted in six schools in Helsinki as part of a larger educational reform promoting digital and student-centred learning arrangements.

The principal argument of our chapter is that, in order to understand the social context of students' learning experiences in making and design learning environments, we need to explore the tensions between the motive orientations students bring in and develop during their making and design activities and the demands of the learning environment situated within the institutional context of the school. We use the term 'motives' to refer to the ways in which the students orient themselves towards and carry out the challenges in the FUSE Studio environment. This focus on the dynamics and tensions between motives and demands as a means of understanding the social context of students' learning experiences also resonates with a Vygotskian understanding of learning and development that locates development in the dialectical interplay between an individual and the sociocultural environment (Vygotsky, 1998, 1994; Hedegaard, 2012a). Our work is guided by the following research questions:

1. How do established school practices interact and come into tension with the students' motive orientations during their making and design activity in the FUSE Studio?

2. How do the motive-demand dynamics detected in the students' social activity in the FUSE Studio mediate their learning experiences?

12.2. Conceptual Framework

We draw on the cultural-historical concepts of demands and motives, as conceptualised by Hedegaard and applied in previous studies to children who are participating, learning and developing in and across different institutional practices, such as home, kindergarten, preschool and/or school (see, e.g. Hedegaard 2012a, b, 2014; Fleer 2014; Salmi & Kumpulainen, 2017).

Hedegaard (2012a, b, 2014) regards demands and motives as central analytical tools in the conceptualisation of learning and development. Motives refer to the child's orientation in an activity setting, which can shed light on the issues that are meaningful and important for the child (Hedegaard,

2012a, 2014; see also Fleer, 2014; Salmi & Kumpulainen, 2017). Underscoring the dialectical movement between children's personal motives and the institutional demands made on them, Hedegaard (2012a, b) demonstrates how both the institutional arrangements and the children themselves contribute to the conditions of learning and development. First, the objectives of institutional practices create demands for children's motives, values and competencies. Children learn and develop through their orientation towards these institutional demands, and hence their motives also change. Secondly, when children participate in and contribute to an activity, they can modify the demands that they confront and navigate. Children's motives thus both shape and are shaped by the activity settings they inhabit (Hedegaard, 2014; Edwards, 2016).

Extending ideas proposed by Vygotsky (1998), Leontiev (1978) and El'konin (1999), Hedegaard (2012a, b, 2008) proposes 'a wholeness approach' for studying children's learning and development from an integrated personal, institutional and societal perspective. From the wholeness perspective, motives and demands are in a dialectical interplay and in a mediated relationship. Learning and development are generated by changes in the 'unity' of the child's motive orientation and the demands of the environment (life world) in which he or she engages (Hedegaard, 2014; also Vygotsky, 1998; Leontiev, 1978). Moreover, the child's participation in a specific activity and his or her transitions from one practice to another typically generate tensions, conflicts, new demands or small crises. These tensions can lead to the reconstruction of the child's motive orientation and are thus essential for the child's development and learning (Hedegaard, 2014; see also Vygotsky, 1998). Hence, tensions that emerge in the motive-demand dynamic during social activity are central to understanding children's learning and development processes within cultural-historical theorising.

In our work, we perceive demands and motives as culturally and institutionally shaped dynamic elements in students' learning and development processes which result from their participation in everyday life. Students' participation in and experiencing of institutional activities—such as participation in the making and design activity in the school FUSE Studio—are influenced and shaped by their personal motive orientation and by the demands of the activity setting (Hedegaard, 2014). On this basis, we regard the students in our study as active participants who make sense of and influence institutional demands in trying to accommodate or fulfil their personal motives within an institutional practice (see also Salmi & Kumpulainen, 2017; Hedegaard & Fleer, 2008; Hedegaard, 2014; Fleer, 2014; Edwards, 2016). We also view learning experiences as being constructed in motive-demand dynamics and in the emerging tensions within students' making and design activities in the sociocultural context of the school (Hedegaard, 2012a, 2014).

12.3. Study Overview

The empirical data of our research comes from a Finnish city-run school with 535 students and 28 teachers at the primary level. Like any other school in Finland, this school follows the national core curriculum, which has been defined locally. The local curriculum of the school stresses design learning, which is considered to enhance students' creative problem-solving skills across the curriculum. The school strives for learner-centredness and for innovations in learning and teaching and is committed to following the principles of progressive inquiry in its pedagogy (as expressed in its local curriculum document of 2016).[1] As a response, the school has recently (in autumn 2016) introduced a new making and design environment called the FUSE Studio as part of its elective courses as a means of enhancing interest-driven, student-centred, empowering, collective and inclusive learning (see also Stevens et al., 2016).

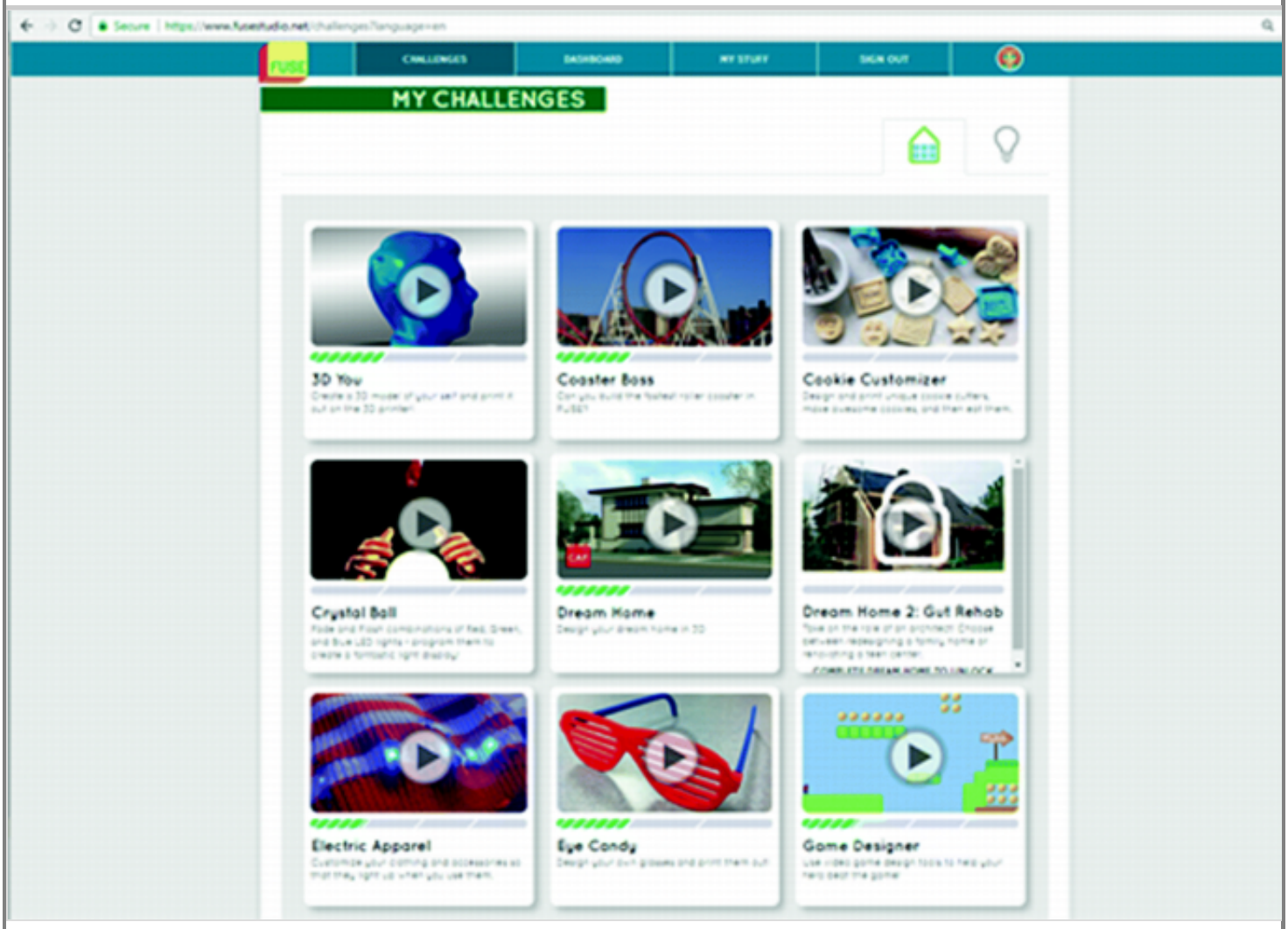
12.4. The FUSE Studio

The FUSE Studio is a making and design environment, 'a choice-based digital infrastructure for STEAM (i.e. Science, Technology, Engineering, Arts, Mathematics) learning' (see Stevens & Jona, 2017). The technological infrastructure of the FUSE environment offers students different STEAM challenges that 'level up' in difficulty like video games. The challenges include *Spaghetti Structures*, *Jewellery Designer, Robot Obstacle Course, Keychain Customiser, Electric Apparel, Coaster Boss* and *Solar Roller.* The challenges are accompanied by various tools, such as computers, 3D printers and other materials (e.g. a foam rubber, a marble, tape and scissors), as well as instructions on how to process the challenges.

Each FUSE challenge is designed to engage students in different STEAM topics and skill sets. The challenges have been carefully structured to introduce students to new ideas and to support them through more complex iterations of those ideas. Students can choose, based on their own interests, which challenges they want to work on, when and with whom. They can choose to work alone or with peers. There is no formal grading or assessment by teachers. Instead, using photos, video or other digital artefacts, students can document their completion of a challenge, and the completion unlocks the next challenge in a sequence. Figure 12.1 shows a student view of the FUSE challenges on a computer screen.

Fig. 12.1

'My Challenges' student interface



In sum, a combination of four elements in the FUSE Studio model makes it a distinctive making and design environment: (1) an interest-driven approach, in which students are free to select which tasks ('challenges') to pursue and when to move on; (2) a levelling-up structure of challenges within sequences, following the basic logic of video game design principles (e.g. Salen & Zimmerman, 2005); (3) a focus on STEM ideas and practices, with a move towards STEAM, by including artistic and design considerations in the criteria by which challenges are posed and judged; and (4) a core focus on cultivating interest in STEM ideas and practices among those who are not already affiliated with them, thereby aiming to broaden access to participation in STEM learning (see also Stevens & Jona, 2017).

12.5. Methods

The primary data of this study comprises 65 h of video recordings of students aged between 9 and 12 years old (N = 94) carrying out making and design activities. The recordings were collected intermittently over a period of one semester. The data comes from three different groups of students and their teachers who participated in the FUSE Studio elective course. Due to the elective nature of the course, the groups consisted of students from several classes. Group 1 consisted of 32 students (22 boys and 10 girls), Group 2 consisted of 30 students (19 boys and 11 girls) and Group 3 consisted of 32 students (19 boys and 13 girls). Each group was supported by two to four teachers and teaching assistants. At the beginning of the autumn, each group had one 45-minute FUSE session a week. Later in the autumn, each session was extended to 60 min.

The video data was transcribed and analysed using interaction analysis methods to take account of verbal, visual and material conduct (Jordan & Henderson, 1995). We then used purposeful sampling of events in the video data to address our research questions. Our analytic approach can be defined as abductive, involving repeated iterations between theory and data (Van Maanen et al., 2007). The analysis proceeded through three major phases. During the first phase, we inductively depicted motives and demands that were made visible in the students' and teachers' social activity during the FUSE sessions; we then entered short descriptions of each identified motive and demand into a computer (Excel) spreadsheet. In the second phase of the analysis, we formed overarching categories of the main types of motives and demands depicted in the data; this required multiple iterations of reading and analysis of the video data, tentatively categorising the data and testing the categories. In the third phase of our analysis, we focused our attention on the dynamics and possible tensions between the identified motives and demands; we also aimed to understand how emerging tensions in the motive-demand dynamics were resolved or overcome and how these dynamics appeared to contribute to the students' learning experiences. Overall, our analysis was guided by the 'wholeness approach' proposed by Hedegaard (2012a, b, 2014) in our attempts to understand how the social contexts of the students' learning experiences were shaped through tension-laden interplay between the motives and demands of their activity situated across personal, relational and institutional contexts.

12.6. Findings

Next, we will highlight three typical motive-demand dynamics that we identified from the students' making and design activities in the FUSE Studio. Our vignettes make visible how established ways of working and being at school interacted and came into tension with the students' motive orientations when taking part in this novel making and design environment, thereby limiting and at times transforming the social context of their learning experiences.

In Vignette 1, *Collective resolution of motive-dynamic tension*, we illuminate how a tension between the

students' motive orientation and the demands of the FUSE Studio triggered a productive motive-demand dynamic that took the students' learning experience beyond the given FUSE Studio challenge. Here, the teacher's interpretation of the demands of the FUSE challenge was instrumental in transforming the activity into a meaningful one for the students and in facilitating a space for joint problem-solving between himself and the students.

Vignette 2, *Motive-demand dynamics enforcing traditions*, illuminates how the students' motive orientation was guided by their earlier engagement in schooling, including its rules and activity patterns, and how this motive orientation persisted in the alternative making and design environment of the FUSE Studio, despite its aim of encouraging reciprocal sharing and relative expertise (Penney, 2016). In this vignette, the teacher enforced traditional ways of working and being at school by acting as the centre of the students' activity. As a result, opportunities were missed for the students to acquire learning experiences in which there could have been collective responsibility and accountability for the learning activity and its material outcomes.

In Vignette 3, *Motives overriding demands*, we demonstrate how the students' motive orientation towards a FUSE challenge strengthened in the process of their work to the extent that they started to disregard the original demands of the FUSE Studio and of their teacher. This vignette demonstrates the students' strong and persistent engagement in generating creative ideas and initiatives, especially when the content of a challenge is intriguing and meaningful to them. Here, the students created a social context, authored by themselves, for their collective creative activity and joint decision-making, an activity more typical of out-of-school learning.

Vignette 1: ***Collective resolution of motive-dynamic tension***

Kasper wants to start working on *Jewellery Designer* (a FUSE Level 1 challenge). He asks the teacher for help. Leevi is standing behind Kasper and wants to know what Kasper is going to do. Kasper explains that he is going to design a wristband and print it out with the 3D printer when it arrives. The instructions for the challenge are in English, and the teacher translates the instructions for Kasper. These instructions ask the student to design a simple earring. Kasper does not want to design earrings and asks the teacher if he can design something else. The teacher replies that in this level he is supposed to design earrings so that he can begin to understand the role of the size of a product in the design process. The teacher then wonders out loud if Kasper could nevertheless design something else the same size as an earring. Leevi suggests that Kasper could design a 'finger thing', and the teacher agrees, because a 'finger thing' is about the same size. The teacher again highlights that the idea is to measure the design.

In this vignette, Kasper's motive to create a wristband and the demand built into the FUSE challenge (to create earrings) did not match and thus created a tension. The vignette demonstrates how a novel learning environment, such as the FUSE Studio with its aim of promoting interest-driven learning, can turn into traditional classroom activity in which the student has to follow tasks and instructions with no opportunities for creative deviations from the plan (see also Rajala & Sannino, 2015). In this case, a productive resolution was reached, with the teacher and another student, Leevi, coming up with an alternative design idea that nevertheless met the learning goals set for the task. The fulfilment of Kasper's motive was reached in social interaction between the teacher and the other student. Here, the teacher's interpretation of the demand is instrumental, in the sense that the teacher interprets the task not as being specifically about designing an earring (i.e. carrying out a school task) but more broadly as being about designing a small item (i.e. acquiring expertise in the design process). The tension and its resolution led Kasper to engage in a learning activity he found meaningful, and it also transformed the activity setting. The teacher and a student together enhanced the possibility for creativity provided by the FUSE Studio by creating a space for this alternative but equally relevant process. In sum, the tension identified in the

motive-demand dynamic and its resolution created a social context for students' learning experiences in which they could work on a challenge they found meaningful.

Vignette 2: ***Motive-demand dynamics enforcing traditions***

A student, Iida, finds it difficult to upload her challenge onto the FUSE Studio website, and she asks the teacher for help. Another student, Laura, approaches the teacher at the same time in order to show her the gloves she has made in the *Electric Apparel* challenge. 'Look what I did,' Laura exclaims to the teacher, who is paying attention only to Iida's computer screen and advising her. The two students have to compete for their teacher's attention and, as the teacher is focusing on Iida, Laura leaves the situation. Iida and the teacher continue with the upload, and Laura comes back a little later to explain to the teacher her solution with loose threads in her gloves. The teacher turns her attention to Laura and comments, 'Wow, unbelievable!' The teacher then turns back to Iida and tells her what to do next. Then she continues to listen to Laura's explanation and nods in agreement. After telling Iida to click 'send', she turns back to Laura and tells her to take her unfinished gloves home so that they are safely stored until next week's lesson. Both students now know what to do, and the teacher leaves.

In this example, we can witness a pattern of social activity accompanying the students' motive orientations that is typical of many traditional classrooms: the students turn to the teacher (and not to each other) to ask for help and to share the outcomes of their work. In this vignette, the teacher maintains her traditional expert position and the teacher-driven style of instructing and interacting with the students. The central role of the teacher in coordinating and mediating many simultaneous activities in the FUSE Studio creates a tension in the attempt to meet every students' motives and needs. Here, the tension is distributed among the teacher and the students. The teacher is unable to simultaneously guide and instruct two students and, on top of this, to oversee the whole FUSE class with its large number of students. The students also strengthen this pattern of activity by turning to the teacher when they face an obstacle during their assignments and by demonstrating their progress and outcomes only to the teacher.

The way the students and the teacher manage the motive-dynamic tension is in contradiction with the principles of the FUSE Studio and many other making and design environments; such environments typically emphasise relative expertise as well as collaborative peer learning and sharing. As a result, the original demand for reciprocal sharing and relative expertise advocated by the FUSE Studio (cf. Penney, 2016) was not activated in this case. Instead, the motive-demand dynamics enforced traditional classroom practices where the teacher is at the centre, and opportunities were missed for the students to acquire learning experiences in which there is collective responsibility and accountability for the learning activity and its material outcomes.

Vignette 3: ***Motives overriding demands***

Two students, Jesse and Jiri, are working on the *Spaghetti Structures* challenge. They are using a number of types of spaghetti and marshmallows to build big constructions. The teacher comes to the students to let them know that there are only a few minutes left and that they should start cleaning up. The teacher reminds the students that they should take a picture of their achievement (a requirement of the FUSE Studio). Jesse asks whether they have to disassemble the construction, as he would rather not do so. The teacher instructs him to take a picture and then disassemble the construction. Another teacher comes and asks if the students timed their work as they were supposed to do. Jesse informs the teacher that 'they just forgot'. The teacher asks the students about their aims for the challenge, implicitly evidencing her expectation of goal-oriented activity. The students explain their constructions to the teachers. The teacher continues to ask the students to specify the challenge, and they explain that the challenge was to get the big marshmallow to stay on top on the construction. The teacher replies, 'Yes, but what were the

instructions?' The students do not answer. Another teacher walks by and says, 'If I remember correctly, the challenge was to use a certain amount of spaghetti and marshmallows and to do it in a certain time. There's a timer that you should have been using.' The boys reply that they did not notice the instruction about the timer. The teacher tells them, 'Go and clean up now. You're using up the whole group's spaghetti and marshmallows, and the others can't take on this challenge.' The students clean up.

In this vignette, the students focused enthusiastically on their joint activity of designing a large construction using spaghetti and marshmallows. The activity was initiated by a FUSE challenge, but soon the students started to follow their own ideas and ways of working. The students found the challenge of *Spaghetti Structures* so compelling that they forgot about the instructions and the time constraint and were driven by their collective motive to create something extraordinary. In sum, this case represents an example where the students' motives and joint creative actions go beyond the instructions and demands of the FUSE Studio and of the teacher. We interpret this as a collective, expansive learning experience for the students, resonating with authentic making and design activities of a type more typically found outside of school. Yet, at the same time, this vignette demonstrates contradictions and tensions between the rules and instructions of the teacher and those of the students, with the students disobeying the teacher and thus evidencing resistance to the established school practices.

12.7. Discussion

In spite of the proliferation of making and design environments, there is a paucity of research knowledge on students' engagement and learning experiences in makerspaces situated in schools. Recent studies have pointed to the benefits of these environments, such as enhancing students' agency, persistence, creative problem-solving and STEM learning (see, e.g. Benton, et al., 2013; Bevan et al., 2016; Honey & Kanter, 2013; Kumpulainen, 2017). Yet little is known about the processes in which students negotiate motives and demands or how tensions caused by motive-demand dynamics are managed at the intersection of novel making and design activities, on the one hand, and established school practices, on the other hand.

To contribute to bridging this gap in research knowledge, we have applied cultural-historical theorising and Hedegaards' (2012a, b, 2014) 'wholeness approach', which we find particularly useful for researching and understanding the dialectic movement between students' personal motive orientations and the demands imposed by the embedding of novel learning environments into established school practices. We hold that, through examination of the motive-demand dynamics and tensions made visible in social activity, it is possible to shed light on the varied—and often contradictory—institutional and activity-related opportunities and constraints that are specific to this novel learning environment embedded in the institutional context of formal education. Moreover, by examining motive orientations that students bring into the activity and that they develop by taking part in the activity, we can begin to understand their learning experiences in novel making and design environments.

Our findings regarding the students' social activity in the FUSE Studio provide evidence of student-driven engagement and learning experiences that differ from traditional classroom practices. These novel aspects include the students pursuing varied interests, developing and building on each other's expertise, and exercising agency in creatively extending the original FUSE challenges and their social activity in general (see, e.g. Ramey, 2017; Penney, 2016; Stevens et al., 2016). At the same time, our study makes visible how the students' participation in the making and design environment is not always straightforward and how it involves tensions and discontinuities.

Our analysis unfolds cases (particularly in Vignette 2) where both the students' motive orientations and

the teacher's activity enforced traditional teacher-centred and teacher-controlled schooling activity in which the teacher is positioned at the centre of activity, acting as the primary source of help and source of feedback to the students' work. These traditional practices are demanding to deal with and difficult to overcome despite in a novel learning environment, since they relate to the historically established practices and rules of the school system. These traditional practices of the school typically support students' enculturation into established practices, knowledge and values, with limited opportunities for cultural negotiation and transformation in which students' social activity supported by their teachers modifies and creates the culture itself (Kumpulainen & Renshaw, 2007).

The tension-laden interplay between alternative motives and resulting tensions present in the social activity in the FUSE Studio evidencing more student-driven activity in which expertise and feedback are distributed among both students and teachers can, however, be seen as a driver for students' alternative learning experiences and institutional change; as in Vignettes 1 and 3, this led to creative resolutions. Tensions and discontinuities are often considered harmful, but within a larger system they can be important opportunities and locations for learning, both among the students and their teachers as well as across whole school communities (see Hubbard, Mehan, & Stein, 2006: 16–18).

The main message of our study to teachers who are carrying out design and making activities within schools is that they need to be able to withstand uncertainty: the learning process of students in a makerspace can never be fully preplanned. Teachers working with children in spaces such as the FUSE Studio should increasingly exercise their professional agency and reflexive thinking to find a balance between old and new ways of working (Rajala & Kumpulainen, 2017). In order for teachers to transform their customary teaching activity and to develop professionally as facilitators of students' learning processes, they need new competencies for proficient handling of the technological infrastructure of design and making environments. Moreover, such novel learning environments call for teachers to create flexible new ways of working with students and with one another as a team. In sum, managing the new demands associated with design and making activity requires constant effort, both from the students and from the teachers. Bridging the gap between established school practices and the student-driven making and design activity can thus be viewed as a continuous process of collective learning, that also require support in the development of the pedagogies associated with the novel initiative. As suggested by earlier research, the emergence of new ways of working and of being at school requires instrumental genesis and calls for co-evolution of the social and technological infrastructures of schools (Hakkarainen, 2009; Kumpulainen, Mikkola, Jaatinen, 2014).
AQ1

12.8. Conclusions

In summary, our work on understanding the educational potential of making and design environments in schools has been inspired by the seminal research of Mariane Hedegaard. In particular, we have adopted and adapted her concepts of motives and demands, and we have investigated their dynamics in institutional practice in a novel context, namely the FUSE Studio design and making environment. These concepts were originally used to research children's social situations of development in and across different activity settings in their everyday lives, taking into account the role played in that development by the institutional contexts in which the activity settings are embedded (Hedegaard, 2008, 2012a, b, 2014). As shown by other researchers who have extended Hedegaard's original work, these concepts have a great potential to inform productive analyses of learning and development in diverse practices, including the professional development of teachers (Edwards, 2017) or of managers in a national postal system (Rodriguez Leal, 2016) and the transition of preschool children to primary school (Salmi & Kumpulainen, 2017).
AQ2

Our work corroborates and informs the emerging line of research on the ways in which new digitally mediated learning arrangements bring about new contradictory motives and demands for children and for teachers and on the need to navigate and negotiate these new motives and demands (see also Fleer, 2014, 2017). As our study shows, Hedegaard's conceptualisation of the dynamics between motives and demands has much to offer in understanding the educational potential of such new learning arrangements and of the tools that are becoming commonplace in contemporary educational settings. Perhaps even more importantly, these concepts help us to understand the conditions under which the educational potential of novel learning environments can be realised or thwarted. We believe that what lies ahead is a fruitful line of research that has great promise for researchers, educators and educational policy makers in understanding and transforming learning and education in the twenty-first century.

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[1] The name of the school has been withheld for reasons of anonymity.